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# Effects of Surf Zone Sediment Properties on Shock Wave Behavior

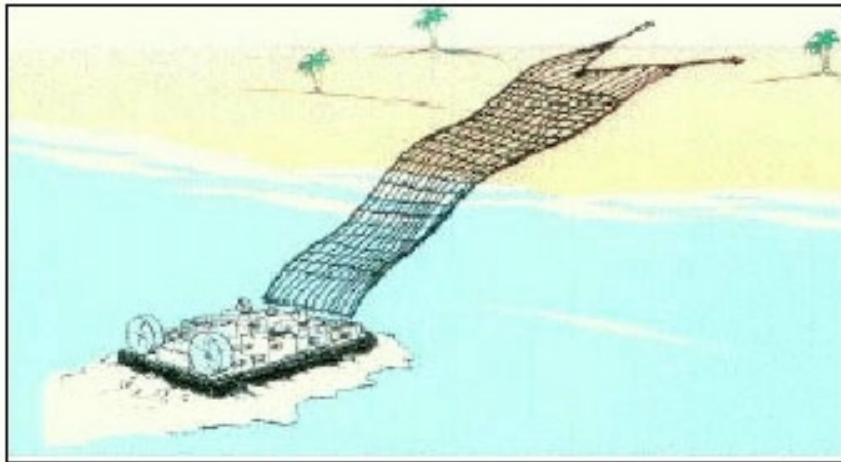
L. Dale Bibee  
Seafloor Geosciences – Code 7432  
Naval Research Laboratory  
Stennis Space Center, MS 39529-5004  
phone: (228) 688-5459 fax: (228) 688-5752 email: [Dale.Bibee@nrlssc.navy.mil](mailto:Dale.Bibee@nrlssc.navy.mil)  
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## LONG-TERM GOAL

The long-term goal is to determine the effect of the properties of seafloor sediments in the surf zone on Naval systems supporting amphibious assault by neutralizing surf zone mines.

## OBJECTIVES

Surf zone mine neutralization will be accomplished with the projection of explosive nets or line charges ahead of approaching landing craft. The effectiveness of these systems in neutralizing the mines is critically dependent upon the propagation effectiveness of shock waves from the charge to the mine. Data and modeling show that this effectiveness is controlled by the properties of the seafloor sediments in the surf zone. The presence of gas trapped in the sediment pore space has been shown to be a first order factor. In addition, modeling predictions require the compressibility of the sediments at high and low pressures. The objective of this project is to evaluate these sediment parameters in natural surf zone environments and compare them to simulated environments being used for explosive testing.



*1. In-stride neutralization of surf zone mines by deploying an explosive net.*

## APPROACH

Techniques have been developed to measure air content and geotechnical properties of surf zone sands by a combination of specialized (sealed) core sampling and *in situ* geoacoustic probe measurements. Gas content measurements are made by measuring bulk compressibility of the cored sediments immediately after the samples are taken. Geotechnical properties of the sediments are made at a later

time in the laboratory using triaxial compression techniques. A range of natural and simulated surf zone areas have been sampled. This work has been done in collaboration with the University of Rhode Island (Dr. Armand Silva).

## **WORK COMPLETED**

A range of surf zones have been sampled. Geotechnical properties have been measured by the University of Rhode Island, Applied Research Associates, and the University of Sydney (under separate funding).

A technical work shop was held in late May to review progress to date in this area.

## **RESULTS**

Air content measurements have shown that, in general, natural surf zone environments have much less trapped gas in the sediments than the simulated environments being used for explosive testing. The primary zones of concern for high gas content are the inter-tidal areas of active surf zones that have a wide distribution of sediment grain sizes.

Triaxial compression measurements generally agree between the University of Rhode Island and University of Sydney work. Significant differences are noted between siliceous and carbonate sediments. The funding for this project, received late in the fiscal year, is primarily for publication of these results and has been forwarded to the University of Rhode Island..

## **IMPACT/APPLICATION**

This work is critical in doing performance prediction for the Navy mine neutralization systems currently undergoing operational evaluation.

## **TRANSITIONS**

The data has been transmitted to NSWC (Indian Head and Panama City) for use in system evaluation.

## **RELATED PROJECTS**

1 – NRL is conducting internal work to simulate surf zone sands in a test tank and initiate shock waves with a high energy laser system. The results will be used to validate numerical model predictions of shock propagation through sands.

## **REFERENCES**

Desrosiers, R. 1999 Stress-Strain and Strength Behavior of Marine Sands at Elevated Confining Stress, University of Rhode Island Masters Thesis.